How to Produce Quality Salmon Scale Impressions

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ABSTRACT

Hudson, M.J., and Crosby, N. 2010. How to produce quality salmon scale impressions. Can. Tech. Rep. Aquat. Sci. 2897: iv + 16 p.

Quality salmon scale impressions facilitate the production of accurate age data for stock assessment purposes by the Sclerochronology Laboratory Program at the Pacific Biological Station, Nanaimo, B.C. This manual provides step by step instructions on how to organize and prepare scale samples for impressing by a modified swing-away heat transfer press. Figures illustrate procedures, materials and equipment and provide examples of good and poor quality scale impressions.

RÉSUMÉ

Hudson, M.J., and Crosby, N. 2010. How to produce quality salmon scale impressions. Can. Tech. Rep. Aquat. Sci. 2897: iv + 16 p.

Les empreintes d'écailles de saumon de bonne qualité permettent d'obtenir des données précises sur l'âge du saumon aux fins d'évaluation des stocks par le Laboratoire de sclérochronologie de la Station biologique du Pacifique, située à Nanaimo, en Colombie-Britannique. Ce manuel contient des instructions pas à pas sur la manière d'organiser et de préparer des échantillons d'écailles pour empreinte avec une presse à thermotransfert orientable modifiée. Les figures illustrent les procédures, matériels et équipement requis, ainsi que des exemples d'empreintes d'écaille de bonne et de mauvaise qualité.

INTRODUCTION

The Sclerochronology Lab (SCL) at the Pacific Biological Station in Nanaimo provides age determination services to Fisheries and Oceans Canada programs within the Pacific Region. The science of sclerochronology includes the study of how growth patterns are formed on the hard tissues of organisms over time. On a yearly basis, the SCL determines the age of over 75,000 salmon (*Oncorhynchus*) by interpreting and counting the annual growth zones formed on scales. This includes Chinook (*O. tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), kokanee (*O. nerka*) and steelhead (*O. mykiss*) from management areas in the Yukon, North Coast, Central Coast, Interior and South Coast of British Columbia.

Annual growth zones, formed by circuli on scales (Fig. 1) are counted to estimate freshwater and saltwater age to produce total age. Accurate age data is a key element of stock assessments that in turn are used to make management decisions to open, close and/or extend salmon fisheries (MacLellan 2004). To produce good quality age data, the scales must be processed in a way that ensures clear images for growth pattern analysis. Making quality scale impressions is vital to the productivity of the SCL and ultimately impacts fisheries and management.

This manual outlines the basic techniques the SCL uses to produce quality scale impressions. It includes a step by step process and illustrates good and poor quality examples. It also provides SCL staff with information regarding maintenance protocols and some operating problems that might occur when using the scale presses.

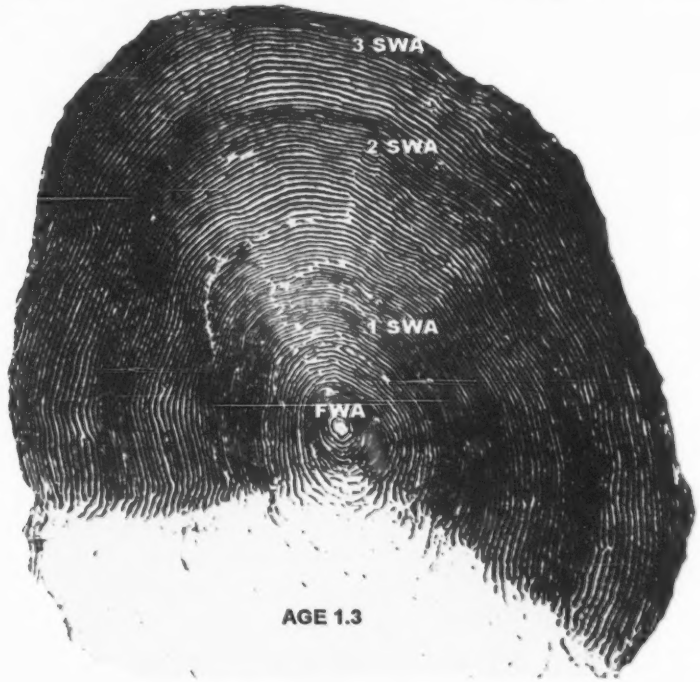

Fig.1. Good chinook scale impression identifying the marine (SWA) and freshwater (FWA) annuli for a 4 year old or a "5-year" fish.

METHODS AND MATERIALS

Every year the SCL receives thousands of salmon scale books from various DFO stock assessment programs carried out in the Yukon, North Coast, Central Coast, Interior and the South Coast of British Columbia. Samples are delivered to the lab and handled by the Salmon Database Technician who is responsible for organizing, storing and preparing the scale books and making good quality scale impressions for subsequent age determination.

The following is a list of equipment and materials used to make scale impressions:

- Scale card (Fig. 2)
- Scale book/card (Fig. 3)
- DK20SP 16X20 Automatic Digital Swinger swing-away heat transfer press (Fig. 4 & 5)
- Stainless steel sheet (Fig. 6)
- Conductive 16"X20" 1/8" thick green high temperature pad. (Fig. 6)
- 1-16"X20" (0.062" thick) fibreglass reinforced silicone sheet (Fig. 6)
- 1- 10"X12" (0.062" thick) fibreglass reinforced silicone sheet (Fig.6 & 7)
- 1- Silicone Zone ™ Large Pastry/Baking Mat (16.5" x 24.4") (Fig. 6)
- Bricks (Fig. 8)
- Scissors
- Highland™ Permanent Mending Tape (any high quality transparent tape will do)
- Clear Acetate cards (Window Film CWF 7000 acetate - 0.020" X 2.500"X 5")

I. ORGANIZING THE SCALE SAMPLE

Samples are organized into "bundles" depending on the type of information listed on the scale books/cards. The standard data quality control procedures are as follows:

1. Sort the salmon scale books/cards by "Project". This identifying information should arrive with each sample or be recognizable from the information recorded on the back of each scale card. If project ID is questionable or unknown, contact the project coordinator to verify. Project names can also be found in the Pacific Age Database System (PADS).
2. Separate the scale books into groups by species, area, sample source, and gear type for each project. This information is checked off or written on the back of the scale card/book (Fig. 2). If information is incomplete, contact the project coordinator for the information.
3. Enter the sample information into PADS at which time a unique sample number will be assigned. See Salmon Database Technician Documentation of Tasks and Pacific Age Database System User Manual (Cooke 2003) for more detailed information regarding database operation and sample input.
4. Complete a sample header card and attach it to each bundle (Fig. 2). Record the following information: project name, PADS sample number, location, species, scale format and number of books. Indicate if there are data sheets with the scale samples. Check off Code Wire Tag (CWT) if the data is available and circuli counts if requested by the client (Fig 2). Bundle the header card and scale cards together and wrap with an elastic band or bands depending on bundle size.

5. Record the sample information in the SCL Salmon Workload Excel file. Quality scale card impressions facilitate the productivity of the readers by making it easier and faster to interpret growth patterns.

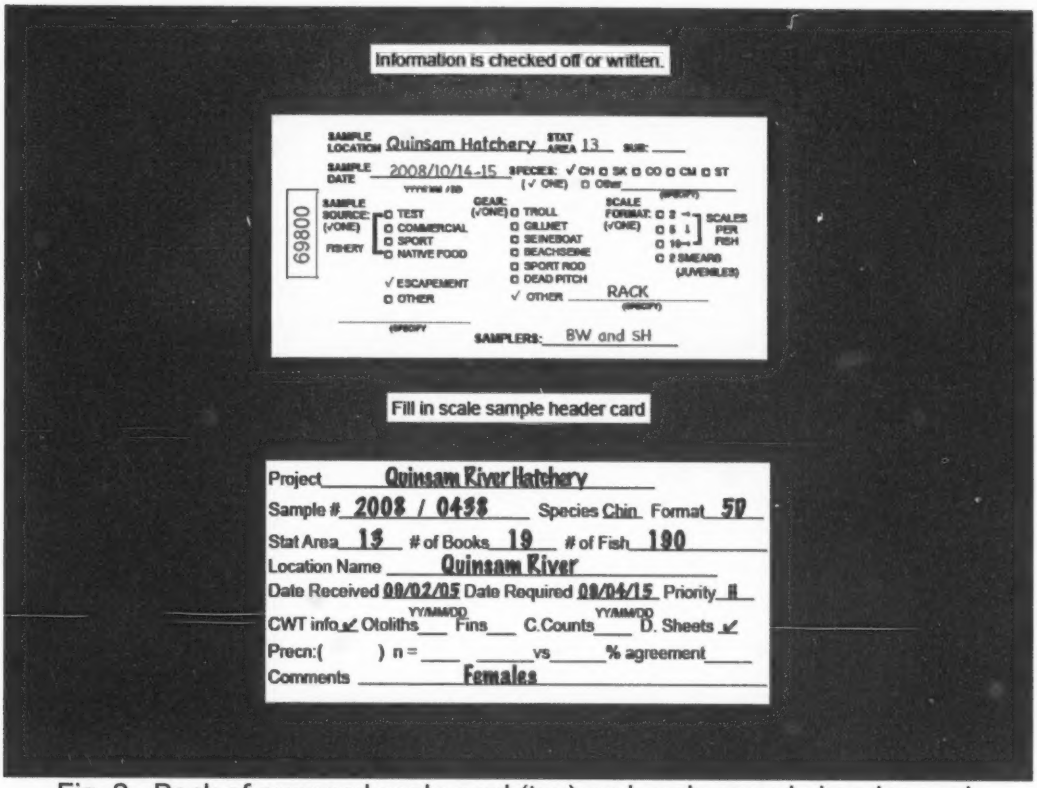
Information is checked off or written.
SAMPLE LOCATION Quinsam Hatchery STAT AREA 13
SAMPLE DATE 2008/10/14-15 SPECIES: ✓CH ☐ SK ☐ CO ☐ CM ☐ ST
69800
SAMPLE SOURCE: ☐ TEST ☐ COMMERCIAL ☐ SPORT ☐ NATIVE FOOD
FISHERY
GEAR: ☐ TROLL ☐ GILLNET ☐ SEINE/BOAT ☐ BEACH SEINE ☐ SPORT ROD ☐ DEAD PITCH
SCALE FORMAT: SCALES PER FISH
✓ ESCAPEMENT
☐ OTHER
✓ OTHER RACK
SAMPLERS: BW and SH
Fill in scale sample header card
Project Quinsam River Hatchery
Sample # 2008 / 0498 Species Chin Format 59
Stat Area 13 # of Books 19 # of Fish 190
Location Name Quinsam River
Date Received 08/02/05 Date Required 08/04/15 Priority 1
CWT info ✓ Otoliths ___ Fins ___ C.Counts ___ D. Sheets ✓
Precn:( ) n = ___ ___ vs ___ % agreement ___
Comments Females

Fig. 2. Back of gummed scale card (top) and scale sample header card.

II. PREPARING SCALE BOOKS/CARDS

Note: Each pre-numbered scale card is sandwiched between a front and back cardboard cover and a piece of tissue paper to protect the gummed surface of the scale card (Fig. 3).

1. Detach the scale card from covers and tissue paper by cutting through all layers of the scale book with scissors just inside the stapled edge. Take care that information on the sample card is not cut off. Remove and discard the front and back covers and tissue paper insert. Keep the glued/gummed scale card with attached scales (bottom Fig. 3).
2. Place a piece of clear acetate on top of the gummed surface of the scale card. Make sure that the edges of both are aligned and the top and bottom row of scales are not too close to the edge of the acetate.
3. Tape the acetate and scale card together on the cut side that was previously stapled using the reccomended tape (Fig. 3). Cut away excess tape ends if necessary.
4. Cut a small corner from the upper right hand corner of the scale card and acetate. The cut corner indicates the location of scale #1 for the readers who determine age from the acetate portion of the final product.

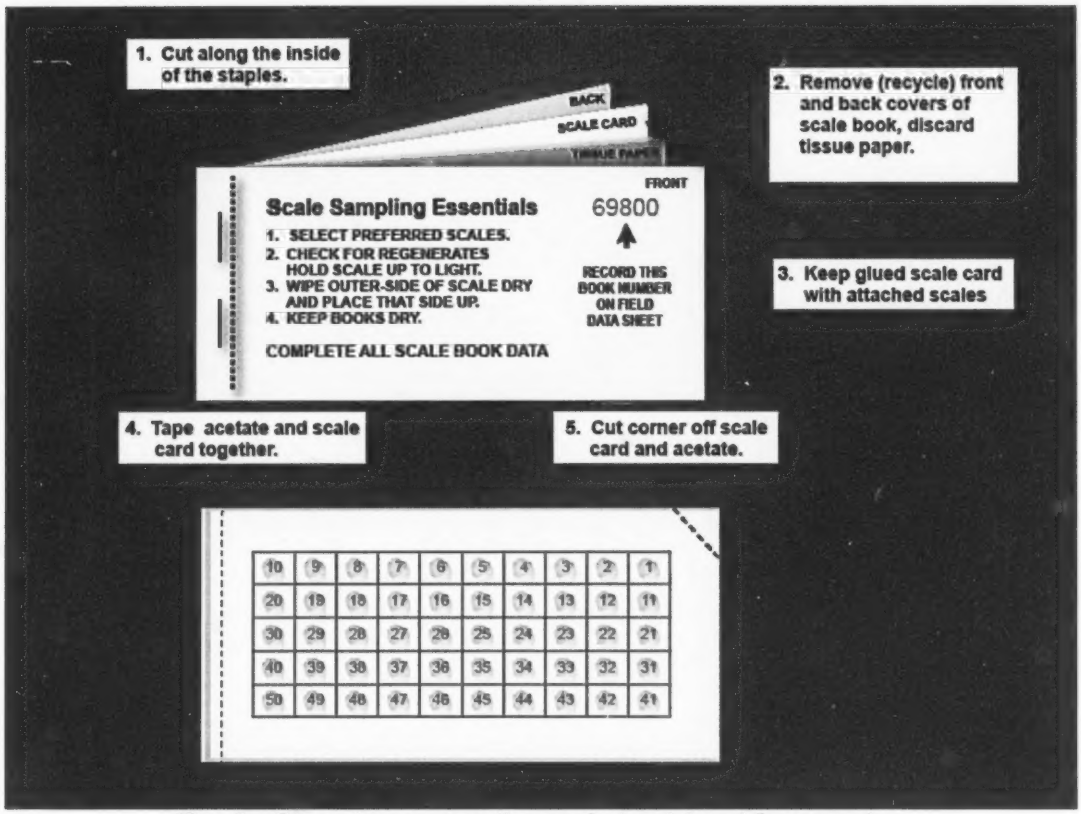
1. Cut along the inside of the staples.
BACK
SCALE CARD
TISSUE PAPER
2. Remove (recycle) front and back covers of scale book, discard tissue paper.
FRONT
Scale Sampling Essentials
69800
1. SELECT PREFERRED SCALES.
2. CHECK FOR REGENERATES HOLD SCALE UP TO LIGHT.
3. WIPE OUTER-SIDE OF SCALE DRY AND PLACE THAT SIDE UP.
4. KEEP BOOKS DRY.
COMPLETE ALL SCALE BOOK DATA
RECORD THIS BOOK NUMBER ON FIELD DATA SHEET
3. Keep glued scale card with attached scales
4. Tape acetate and scale card together.
5. Cut corner off scale card and acetate.
10 9 8 7 6 5 4 3 2 1
20 19 18 17 16 15 14 13 12 11
30 29 28 27 26 25 24 23 22 21
40 39 38 37 36 35 34 33 32 31
50 49 48 47 46 45 44 43 42 41

Fig. 3. Steps to prepare the scale book/card for pressing

III. MAKING SCALE IMPRESSIONS

The DK20SP 16X20 Automatic Digital Swinger is a compressed air operated swing away heat transfer press (scale press) with state of the art control system and heavy duty solid steel welded framework (Geo Knight & Co Inc). The automatic pressing and push button activation ensures safe, ergonomic and productive operation.

Tip: ***Use caution when handling <u>hot</u> (but still OK to handle with bare hands) silicone pads, stainless steel sheet and taped/acetate scale cards.***

1. Turn on the scale press (Fig. 4) and wait for the temperature to reach 107° C before starting to press scale cards. It takes approximately 5 minutes for the scale press to reach the recommended operating temperature. First time scale press users should read the DK20SP 16x20 Automatic Digital Swinger operational manual which is located in the Sclerochronology Lab (Room T102B).

2. Turn on the compressed air connected to the scale press(es) by turning the lever(s) counter clockwise perpendicular to pipe. Conversely, to close the compressed air intake, turn the lever(s) clockwise (Fig 5).

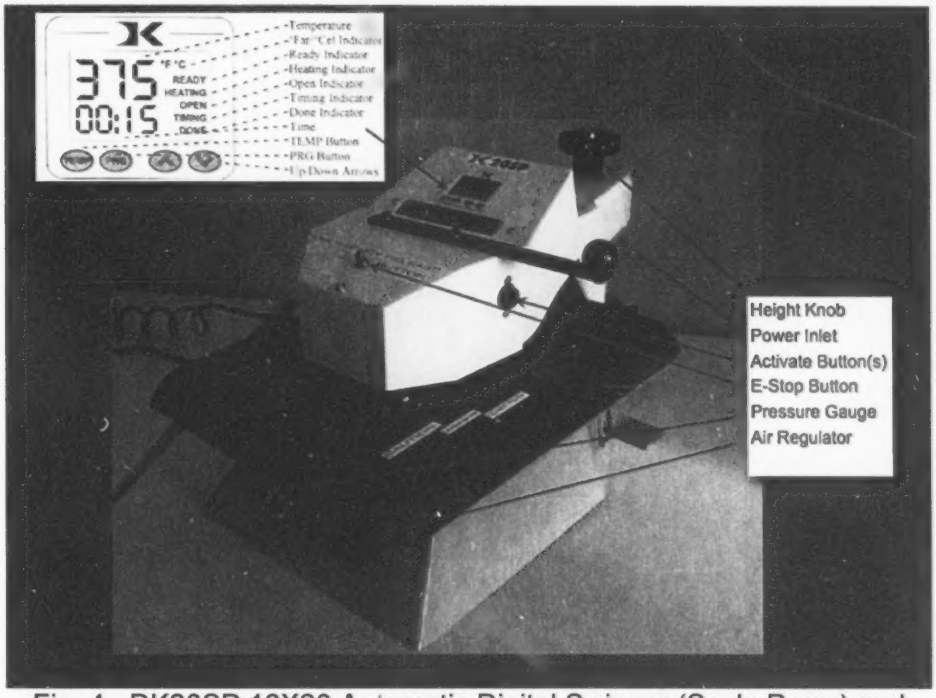

Fig. 4. DK20SP 16X20 Automatic Digital Swinger (Scale Press) and Default Operation Mode of Controller.

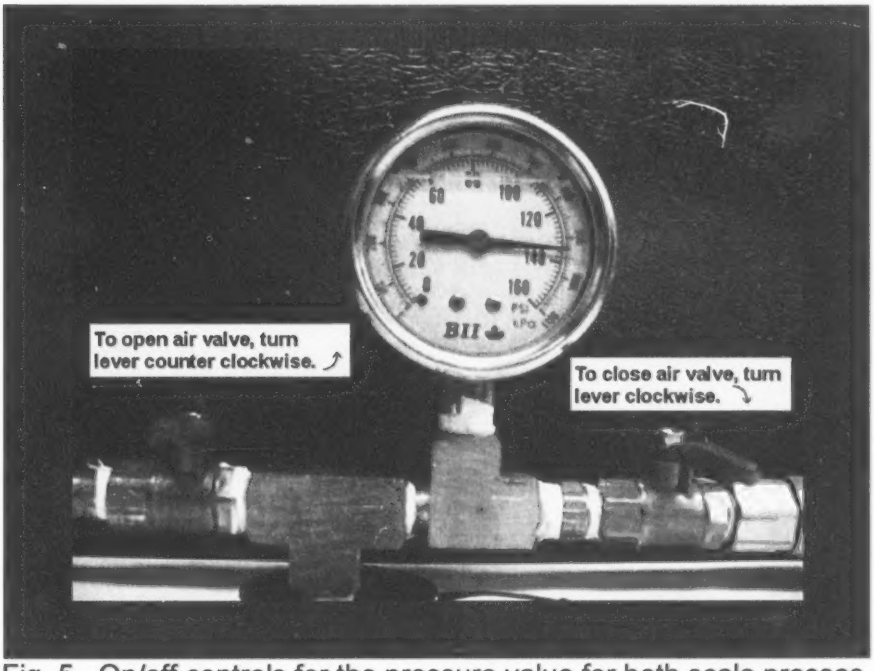

Fig. 5. On/off controls for the pressure value for both scale presses.

3. Check and arrange the silicone mats and stainless steel sheet in the following top to bottom order (Fig. 6).
   i) SiliconeZone™ baking mat

ii) 10"X12" 0.062" thick fibreglass reinforced silicone sheet (smaller size red silicone sheet)
iii) 16"X20" 0.062" thick fibreglass reinforced silicone sheet (full size red silicone sheet)
iv) conductive 16"X20" 1/8" thick green high temp pad (green silicone sheet)
v) stainless steel sheet

4. Activate the scale press for 3.5 minutes before adding scale cards. This allows the silicone pads to heat up and ensures that all books receive an equal amount of heat exposure. Make sure the top and bottom plates are aligned and push both Activate buttons. The compressed air will push the plates together. The machine will count down the time and open when completed (you will hear the compressed air discharge from the air bladder). There is an E-stop button on the front of the machine (Fig. 4) which will automatically release the pressure in case of emergency.

5. Swing open the top of the scale press and remove the SiliconeZone™ baking mat. Flip over the small red silicone sheet and place it squarely in the centre of the press. Neatly place two rows of three taped acetate/scale cards, with the acetate side facing down as illustrated in Fig. 7.

6. Make sure the taped acetate/scale cards are carefully placed to avoid any overlap and then replace the SiliconeZone™ baking mat with the bottom side up on top of the scale cards. Use both hands to smooth out any air bubbles that could be trapped between the scale cards and the SiliconeZone™ baking mat. Swing the top of the scale press back in place over the bottom plate.

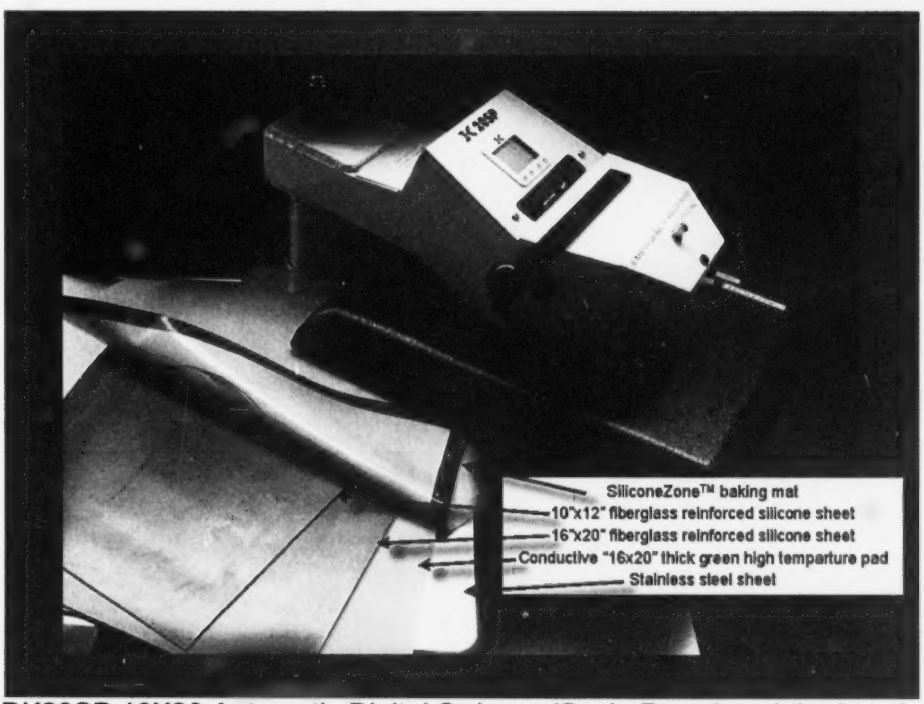
SiliconeZone™ baking mat
10"x12" fiberglass reinforced silicone sheet
16"x20" fiberglass reinforced silicone sheet
Conductive "16x20" thick green high temparture pad
Stainless steel sheet

Fig. 6. DK20SP 16X20 Automatic Digital Swinger (Scale Press) and the layering order of the silicone pads and stainless sheet used for pressing scales.

Fig. 7. Scale card placement on 10"X12" 0.062" thick fibreglass reinforced silicone sheet.

7. Push both activate buttons together to begin the 3.5 minutes pressing process. All salmon scale books are pressed at 107°C for 3.5 minutes at maximum pressure. If it becomes difficult to create a clear impression, then increase the time by 1-15 seconds and/or increase the temperature by 1-5° C maximum.

8. Once the pressure releases, separate the plates and remove the SiliconeZone™ baking mat to expose the scale cards.

9. Remove each of the hot, taped acetate/scale cards from the silicone sheet. Gently peel the acetate and scale card apart, leaving them taped together; then place under brick to flatten and cool (Fig. 8).

Note: Care must be taken to avoid rippling and/or bending of the acetate while removing acetate/scale cards from silicone sheet.

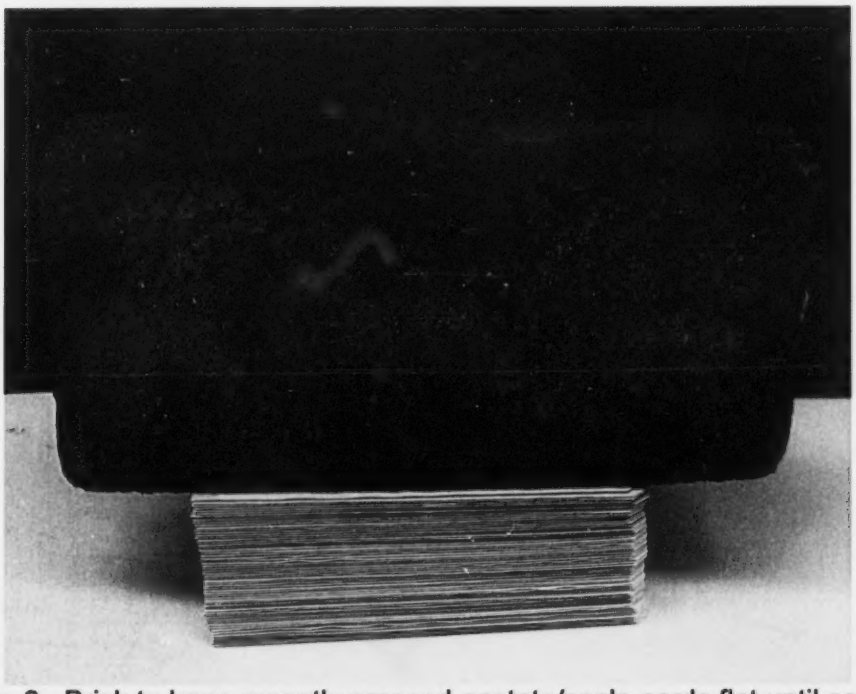

Fig. 8. Brick to keep recently pressed acetate/scale cards flat until cool.

10. When cool (about 1-2 minutes) remove each taped acetate/scale card from under the brick and check the quality of the scale impressions under the overhead lighting. Each acetate should present clear, distinct impression of all the scales and/or scale smears. Each scale impression should be distinct in all regions (margins, centre anterior, posterior) (Fig. 9 and 10).

Fig. 9. Distinct, properly pressed chinook scale impression.

Fig.10. Distinct, properly pressed sockeye scale impression.

11. If any or all scale impressions look indistinct or impressed too "lightly" into the acetate (Fig. 11 &12) then another impression is required.

Note: Sometimes, scales fall off the scale card after the first pressing or later during handling for age determination. In the case where duplicate impressions are required, always keep and label the first pressing as well as any subsequent pressings to ensure the most complete representation of a sample.

Fig.11. Indistinct, poorly pressed chinook scale impression.

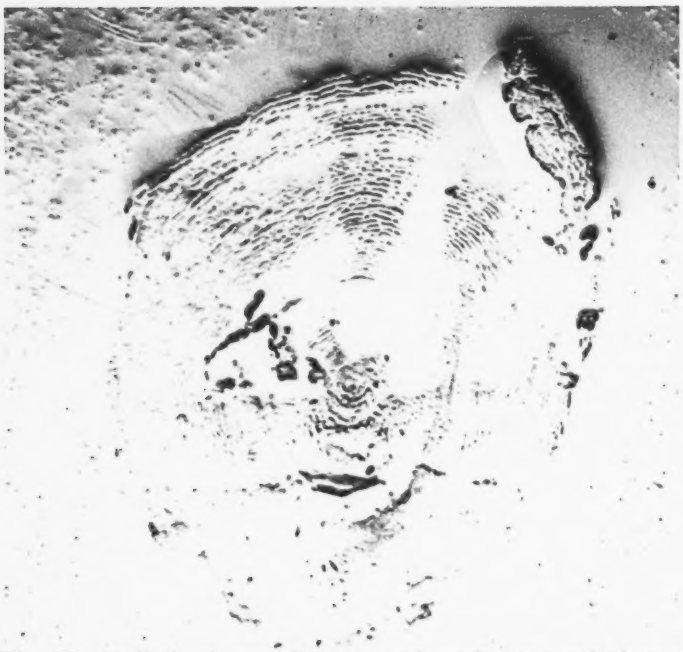

Fig.12. Indistinct, poorly pressed sockeye scale impression.

12. Once all the scale cards in a sample are pressed, arrange them in chronological order (by date) and then by book number within the dates. Next, organize the scale cards with the printed side face up (acetate down) with the earliest date at the top of the stack. Scale presser must record their initials in the top right corner of the sample header card accompanying the scale cards (Fig. 13).

Note: Do not mix-up scale cards between sample header cards. This can cause problems later when entering data. If unsure, check database to confirm before proceeding.

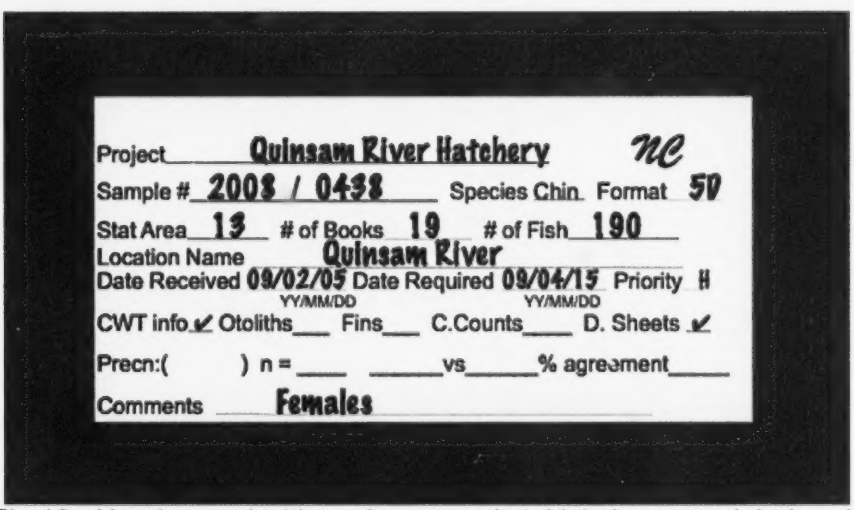
Project Quinsam River Hatchery NC
Sample # 2008 / 0438 Species Chin Format 50
Stat Area 13 # of Books 19 # of Fish 190
Location Name Quinsam River
Date Received 09/02/05 Date Required 09/04/15 Priority H
YY/MM/DD YY/MM/DD
CWT info ✓ Otoliths___ Fins___ C.Counts___ D. Sheets ✓
Precn:( ) n = ___ ___vs___% agreement___
Comments Females

Fig.13. Header card with scale presser's initials in upper right hand corner.

13. Deliver samples to the salmon scale reading area and arrange by species on "work pending" shelf according to date required.

14. Record the pressing date in the salmon workload excel file. This program is used to track sample analysis progress.

IV. DUPLICATE IMPRESSIONS OF SCALE CARDS

Some of the Yukon/NBC projects require the SCL to provide duplicate impressions of salmon scale samples sent for age analysis. These samples are usually to support joint fisheries work between Canada and the U.S. on transboundary chinook and sockeye salmon stocks. This process takes up to 10 minutes per card for chinook and 7 minutes for sockeye (short cut method).

1. Arrange original scale cards in chronological order (by date) and then by book number within the dates.
2. Photocopy the header card and the data side of all of the scale cards to produce duplicates. Then cut each card from the sheet.
3. Arrange the duplicate cards in chronological order and then by book number within the dates.
4. Write the scale card number on to the 1st acetate impression with a dark permanent marker before detaching from the original scale card.
5. Attach a new acetate to the original card and cut off the upper right corner of both card and acetate.
6. Follow regular pressing procedures (steps 1-12).
7. Remove the duplicate impressions from the scale cards. Tape these to the photocopied cards and bundle them with the photocopied header card.
8. Re-tape the original acetate scale impression back with the original scale card and re-bundle with original header card.

Shortcut: If no scale cards are photocopied attach a sheet listing scale card information (containers) generated from PADS container input section of the submission.

V. MAINTENANCE OF EQUIPMENT

1. Once the pressing process is complete, return tape, scissors, pens and acetate to the SCL's equipment cupboard and lock it.
2. Turn scale press(es) off.
3. Turn pressure valve(s) off.
4. Make sure the small red silicone pad is clean. If not, gently wash it with soap and water. Replace the SiliconeZone™ baking mat when it has become embedded with dirt and/or changes to a "darkish" golden-brown color.
5. Make sure that all electrical connections are sound and that the air lines are unimpeded.

VI. SCALE EQUIPMENT SUPPLIERS

Scale Press:
If a technical or mechanical problem arises with the DK20SP 16X20 Automatic Digital Swinger scale press, contact the Canadian Geo Knight distributor:

Value-Rite Business Products Inc. contact: Jay DeGenova
7280 Victoria Pk Ave # E
Markham, Ontario
L3R 2M5
Ph: 905-477-4668
Toll free: 1-800-242-8069
Fax: 905-477-5131
Web: www.valuerite.com

Acetate Suppliers:

Sabic Polymershape contact: Mark Nilson
104-11 Burbidge Street
Coquitlam BC
V3K-7B2
Ph: 604-468-2112
Toll Free: 1-800-663-4122
Fax: 604-468-2114
E-Mail: mark.nilson@sabic-ip.com
Web: www.sabic-ip.com

Grafix Inc. contact: Cynthia Hronek
5800 Pennsylvania Ave.
Maple Hgts., OHIO 44137
Ph: 216-581-9041 ext. 139
Toll Free: 1-800-447-2349
Fax: 216-581-9041
Email: cynthia@grafixplastics.com
Web: www.grafixplastics.com

Silicone Sheeting Supplier:

Stockwell Elastomerics, Inc. contact: Brian Shipley or Bob Zarr
4749 Tolbut Street
Philadelphia, PA 19136
Ph: 215-335-3005
Fax: 215-335-9433
Email: Bshipley@Stockwell.com
bzarr@Stockwell.com
Web: www.stockwell.com

SiliconeZone Large Pastry/Baking Mat Supplier:

Goidas Kitchen Inc:
2885 Argentia RD. Unit 6,
Mississauga, Ontario,
L5N 8G6
Ph: 905-816-9995
Toll Free: 1-866-465-3299. Fx: 905-816-9997
Email: goida@goidaskitchen.com
Web: www.goidaskitchen.com

APPENDIX 1. LIST OF FIGURES

Fig. 1. Good chinook scale impression identifying the marine (SWA) and freshwater (FWA) annuli for a 4 year old or a "5-year" fish.

Fig. 2. Back of gummed scale card (top) and scale sample header card.

Fig. 3. Steps to prepare the scale book/card for pressing.

Fig. 4. DK20SP 16X20 Automatic Digital Swinger (Scale Press) and Default Operation Mode of Controller

Fig. 5. On/off controls for the pressure value for both scale presses.

Fig. 6. DK20SP 16X20 Automatic Digital Swinger (Scale Press) and the layering order of the silicone pads and stainless sheet used for pressing scales.

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Fig.12. Indistinct, poorly pressed sockeye scale impression.

Fig.13. Header card with scale presser's initials in the upper right hand corner.

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MacLellan, S.E. 2004. DFO Unpublished manual. Guide for Sampling Structures used in Age Determination of Pacific Salmon.

Geo Knight & Co. Inc. Unpublished. DK 20SP Digital Knight 16X20 Automatic Digital Swinger Heat Transfer Press User Manual.

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